Producing Reports with SAS

by Elvira Agrón

TASC/Advanced Support Team
Center for Information Technology
National Institutes of Health

May 17-18, 2001

Table of Contents

Course Description

This course shows you how to create reports using the REPORT procedure of the Base SAS System:

Specifically, you will learn how to:

- create various styles of reports
- add summarization lines
- include statistics in the report
- calculate new columns
- customize the report
- create an output SAS data set
- save the report definition permanently
- use the report definition

These course notes can be found in the Training section of our website: http://statsoft.nih.gov.

Documentation

- SAS Guide to the REPORT Procedure, Release 6.11
- SAS Guide to the REPORT Procedure, Usage and Reference, Version 6
- SAS Technical Report P-258: Using the REPORT Procedure in a Nonwindowing Environment, Release 6.07

View the SAS OnlineDoc, Version 8, in our website:

http://statsoft.nih.gov

The Sample Data Set: AWARDS

The SAS data set **AWARDS** contains information on grants given to medical schools in DC, MD and VA in 1996 and 1997. There is an observation for each school with the total number of awards.

The variables are:

YEAR	year award granted
STNAME	state name
UNIVNAME	university name
CONN	number of contracts awards
CONAMT	amount of contracts awards

The Sample Data Set: AWARDS

FELN	number of fellowship awards
FELAMT	amount of fellowship awards
RESN	number of research awards
RESAMT	amount of research awards
TRAN	number of training awards
TRAAMT	amount of training awards
OTHN	number of other awards
OTHAMT	amount of other awards

The Sample Data Set: AWARDS

OBS	UNIVNAME	STNAME	RESN	RESAMT
1	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	MARYLAND	560	181608047
2	UNIVERSITY OF MARYLAND SCH OF MEDICINE	MARYLAND	221	47330824
3	UNIVERSITY OF VIRGINIA SCH OF MEDICINE	VIRGINIA	178	41466312
4	GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	DIST OF COL	134	32118502
5	VIRGINIA COMMONWEALTH UNIV MED COL OF VA	VIRGINIA	141	33955259
6	GEORGE WASHINGTON UNIV SCH OF MEDICINE	DIST OF COL	26	7097448
7	HOWARD UNIVERSITY COLLEGE OF MEDICINE	DIST OF COL	14	4904997
8	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	VIRGINIA	18	3472404
9	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	MARYLAND	579	187473322
10	UNIVERSITY OF MARYLAND SCH OF MEDICINE	MARYLAND	237	50614013
11	UNIVERSITY OF VIRGINIA SCH OF MEDICINE	VIRGINIA	208	47942379
12	GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	DIST OF COL	140	33651458
13	VIRGINIA COMMONWEALTH UNIV MED COL OF VA	VIRGINIA	133	34256198
14	HOWARD UNIVERSITY COLLEGE OF MEDICINE	DIST OF COL	15	6569248
15	GEORGE WASHINGTON UNIV SCH OF MEDICINE	DIST OF COL	27	7015966
16	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	VIRGINIA	16	3248901
17	U S UNIFORMED SERVICES UNIV HLTH SCIS	MARYLAND	1	97773

OBS	TRAN	TRAAMT	CONN	CONAMT	FELN	FELAMT	OTHN	OTHAMT	YEAR
1	44	8795463	17	10304633	57	1624258	3	1574112	1996
2	10	878818	8	3945118	11	276044	0	0	1996
3	14	2442739	0	0	22	622612	1	132978	1996
4	4	461360	11	5288387	10	246684	0	0	1996
5	10	1253788	5	1647325	9	221020	0	0	1996
6	0	0	2	1204952	6	136783	1	734544	1996
7	2	623425	1	75000	2	70948	0	0	1996
8	0	0	1	2670	2	48626	0	0	1996
9	42	9478438	15	11788806	50	1476525	1	86085	1997
10	12	1369113	6	2591474	13	360007	1	148886	1997
11	14	2783142	0	0	22	618832	2	344422	1997
12	6	884139	8	4024313	14	340851	0	0	1997
13	6	1007380	5	1515404	8	233707	0	0	1997
14	2	332227	2	1892193	1	30289	0	0	1997
15	0	0	3	1254142	4	126803	0	0	1997
16	0	0	1	31178	1	16718	0	0	1997
17	0	0	0	0	0	0	1	149990	1997

Usage Modes

The REPORT procedure can be used in two modes:

- windowing environment

  a “point-and-click” facility

- non-windowing environment

  you submit statements to SAS

In this course we will discuss the non-windowing environment.

Sample Reports

Sample 1

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	University	Number Awards	Total Amount
1996	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	560	$181,608,047
1996	MARYLAND	UNIVERSITY OF MARYLAND SCH OF MEDICINE	221	$47,330,824
1996	VIRGINIA	UNIVERSITY OF VIRGINIA SCH OF MEDICINE	178	$41,466,312
1996	DIST OF COL	GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	134	$32,118,502
1996	VIRGINIA	VIRGINIA COMMONWEALTH UNIV MED COL OF VA	141	$33,955,259
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	26	$7,097,448
1996	DIST OF COL	HOWARD UNIVERSITY COLLEGE OF MEDICINE	14	$4,904,997
1996	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	18	$3,472,404
1997	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	579	$187,473,322
1997	MARYLAND	UNIVERSITY OF MARYLAND SCH OF MEDICINE	237	$50,614,013
1997	VIRGINIA	UNIVERSITY OF VIRGINIA SCH OF MEDICINE	208	$47,942,379
1997	DIST OF COL	GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	140	$33,651,458
1997	VIRGINIA	VIRGINIA COMMONWEALTH UNIV MED COL OF VA	133	$34,256,198
1997	DIST OF COL	HOWARD UNIVERSITY COLLEGE OF MEDICINE	15	$6,569,248
1997	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	27	$7,015,966
1997	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	16	$3,248,901
1997	MARYLAND	U S UNIFORMED SERVICES UNIV HLTH SCIS	1	$97,773

Sample 2

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	University	Number Awards	Total Amount
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	26	$7,097,448
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	134	$32,118,502
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	14	$4,904,997
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	560	$181,608,047
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	221	$47,330,824
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	18	$3,472,404
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	178	$41,466,312
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	141	$33,955,259
1997	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	27	$7,015,966
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	140	$33,651,458
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	15	$6,569,248
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	579	$187,473,322
		U S UNIFORMED SERVICES UNIV HLTH SCIS	1	$97,773
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	237	$50,614,013
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	16	$3,248,901
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	208	$47,942,379
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	133	$34,256,198

Sample 3

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	University	Research Grants N	Research Grants Total
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	26	$7,097,448
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	134	$32,118,502
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	14	$4,904,997
			174	$44,120,947
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	560	$181,608,047
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	221	$47,330,824
			781	$228,938,871
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	18	$3,472,404
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	178	$41,466,312
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	141	$33,955,259
			337	$78,893,975
			1,292	$351,953,793

Sample 3

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	University	Research Grants N	Research Grants Total
1997	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	27	$7,015,966
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	140	$33,651,458
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	15	$6,569,248
			182	$47,236,672
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	579	$187,473,322
		U S UNIFORMED SERVICES UNIV HLTH SCIS	1	$97,773
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	237	$50,614,013
			817	$238,185,108
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	16	$3,248,901
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	208	$47,942,379
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	133	$34,256,198
			357	$85,447,478
			1,356	$370,869,258

Sample 4

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Number Awards	Total Amount
1996	DIST OF COL	174	$44,120,947
	MARYLAND	781	$228,938,871
	VIRGINIA	337	$78,893,975
1997	DIST OF COL	182	$47,236,672
	MARYLAND	817	$238,185,108
	VIRGINIA	357	$85,447,478

Sample 5

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia
Minimum and Maximum Amounts

Year	State	Minimum	Maximum
1996	DIST OF COL	$4,904,997	$32,118,502
	MARYLAND	$47,330,824	$181,608,047
	VIRGINIA	$3,472,404	$41,466,312
1997	DIST OF COL	$6,569,248	$33,651,458
	MARYLAND	$97,773	$187,473,322
	VIRGINIA	$3,248,901	$47,942,379

Sample 6

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

	1996		1997	
State	Number Awards	Total Amount	Number Awards	Total Amount
DIST OF COL	174	$44,120,947	182	$47,236,672
MARYLAND	781	$228,938,871	817	$238,185,108
VIRGINIA	337	$78,893,975	357	$85,447,478

Sample 7

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Contracts	Fellowships	Research	Training	Other	Total
1996	DIST OF COL	14	18	174	6	1	213
	MARYLAND	25	68	781	54	3	931
	VIRGINIA	6	33	337	24	1	401
		ffffffffff	*ffffffffff*	*ffffffffff*	*ffffffffff*	*ffffffffff*	*ffffffffff*
		45	119	1,292	84	5	1,545
1997	DIST OF COL	13	19	182	8	0	222
	MARYLAND	21	63	817	54	3	958
	VIRGINIA	6	31	357	20	2	416
		ffffffffff	*ffffffffff*	*ffffffffff*	*ffffffffff*	*ffffffffff*	*ffffffffff*
		40	113	1,356	82	5	1,596

The PROC REPORT Statement

This statement invokes the procedure.

PROC REPORT *options*;

Some options are:

DATA=	data set to process
OUT=	output data set to create
NOWD	invokes the non-windowing mode
HEADSKIP	writes a blank line under column headers
HEADLINE	writes a line under the header
MISSING	treats missing values as valid values for order, group or across variables
SPLIT=	specifies the splitting character used in the column headers (default: /)

The PROC REPORT Statement

PANELS=	specifies the number of panels of the report
COLWIDTH=	specifies the column width for all columns containing computed or numeric data set variables (default: 9)
OUTREPT=	specifies the catalog entry where the report definition should be saved
REPORT=	specifies the report definition to use
NOEXEC	suppresses the building of the report

New in Version 8:

FORMCHAR=	defines the characters used to draw lines and boxes in the report
BOX	surrounds report items in boxes (like PROC FREQ)

The PROC REPORT Statement

Examples:

```
proc report data=rep.awards nowd headskip;

proc report data=rep.awards nowd headskip headline;

proc report data=rep.awards nowd
     outrept=rep.reports.report1 noexec;
```

Variables to Include in Report

Specify the variables you want to display or use in the report with the **COLUMN** statement. The columns will be displayed in the order you list them. The COLUMN statement is not required.

Examples:

```
column year stname univname resn resamt;
```

```
column year stname univname
       ('Research Grants' '--' resn resamt);
```

```
column stname year,(resn resamt);
```

```
column year stname resamt=resmin resamt=resmax;
```

Usage of Variable

PROC REPORT uses variables according to the usages you specify in the **DEFINE** statements. Valid usages are:

DISPLAY	ORDER
GROUP	ACROSS
ANALYSIS	COMPUTED

By default, character variables are defined as display variables and numeric variables are defined as analysis variables.

The DEFINE Statement

DEFINE *var / usage options*;

usage	defines the usage type	
options	this is a partial list of the options	
FORMAT=	format to use with the column (abb. F=)	
DESCENDING	displays values in descending order	
ORDER=	orders values	
	DATA	by their order in data set
	FORMATTED	by the formatted values (default)
	FREQ	by ascending count
	INTERNAL	by their unformatted values

The DEFINE Statement

column_header	column label in quotes
CENTER|LEFT|RIGHT	specifies the justification of the formatted values within the column width (default: numeric/right, character/left)
SPACING=	number of blank characters to leave between the column being defined and the one to its left (default: 2)
WIDTH=	defines the column width
NOPRINT	suppresses the display of the column
statistic	see **Analysis Variable** section

DEFINE statements are optional.

Display Variable

They appear as they do in the input data set.

When one or more display variable appears in the report, every observation of the data set is displayed in the report.

Display Variable

In **sample 1** all variables are defined as display variables:

```
title  'NIH Research Awards Granted to Medical Schools';
title2 'District of Columbia, Maryland and Virginia';
proc report data=rep.awards nowd headskip;
 column year stname univname resn resamt;
 define year / 'Year' display;
 define stname / 'State' display;
 define univname / 'University' display;
 define resn / 'Number/Awards' display;
 define resamt / 'Total/Amount' display;
 format resamt dollar14.;
run;
```

Note: The slash in `'Number/Awards'` is a split character.

Sample 1

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	University	Number Awards	Total Amount
1996	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	560	$181,608,047
1996	MARYLAND	UNIVERSITY OF MARYLAND SCH OF MEDICINE	221	$47,330,824
1996	VIRGINIA	UNIVERSITY OF VIRGINIA SCH OF MEDICINE	178	$41,466,312
1996	DIST OF COL	GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	134	$32,118,502
1996	VIRGINIA	VIRGINIA COMMONWEALTH UNIV MED COL OF VA	141	$33,955,259
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	26	$7,097,448
1996	DIST OF COL	HOWARD UNIVERSITY COLLEGE OF MEDICINE	14	$4,904,997
1996	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	18	$3,472,404
1997	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	579	$187,473,322
1997	MARYLAND	UNIVERSITY OF MARYLAND SCH OF MEDICINE	237	$50,614,013
1997	VIRGINIA	UNIVERSITY OF VIRGINIA SCH OF MEDICINE	208	$47,942,379
1997	DIST OF COL	GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	140	$33,651,458
1997	VIRGINIA	VIRGINIA COMMONWEALTH UNIV MED COL OF VA	133	$34,256,198
1997	DIST OF COL	HOWARD UNIVERSITY COLLEGE OF MEDICINE	15	$6,569,248
1997	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	27	$7,015,966
1997	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	16	$3,248,901
1997	MARYLAND	U S UNIFORMED SERVICES UNIV HLTH SCIS	1	$97,773

Order Variable

Rows in the report are sorted according to the order variables when there is no display variable to the left of an order variable.

By default, rows are sorted by the formatted values of the order variables if they are formatted. If not, then the rows are sorted by the internal values.

The option DESCENDING can be used in the DEFINE statement to reverse the order of the rows.

Order Variable

In **sample 2** YEAR, STNAME and UNIVNAME are order variables:

```
proc report data=rep.awards nowd headskip headline;
 column year stname univname resn resamt;
 define year / 'Year' order;
 define stname / 'State' order;
 define univname / 'University' order;
 define resn / 'Number/Awards' display;
 define resamt / 'Total/Amount' display;
 format resamt dollar14.;
run;
```

Sample 2

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	University	Number Awards	Total Amount
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	26	$7,097,448
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	134	$32,118,502
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	14	$4,904,997
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	560	$181,608,047
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	221	$47,330,824
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	18	$3,472,404
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	178	$41,466,312
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	141	$33,955,259
1997	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	27	$7,015,966
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	140	$33,651,458
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	15	$6,569,248
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	579	$187,473,322
		U S UNIFORMED SERVICES UNIV HLTH SCIS	1	$97,773
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	237	$50,614,013
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	16	$3,248,901
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	208	$47,942,379
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	133	$34,256,198

Analysis Variable

An analysis variable is used to calculate statistics for all the observations represented by a group of observations.

By default, numeric variables are treated as analysis variables used to calculate the SUM statistic. Valid statistics are:

N	NMISS	MEAN	STD	MIN	MAX
RANGE	SUM	USS	CSS	STDERR	CV
T	PRT	VAR	SUMWGT	PCTN	PCTSUM

New in 8.1:

P1	P5	P10	P25/Q1	P50/Q2/MEDIAN
P75/Q3	P90	P95	P99	QRANGE

Analysis Variable

In **sample 3** RESN and RESAMT are defined as analysis variables so we can get values in the summary line.

```
proc report data=rep.awards nowd headskip headline;
 column year stname univname
        ('Research Grants' '--' resn resamt);
 define year / 'Year' order;
 define stname / 'State' order;
 define univname / 'University' order;
 define resn / 'N' analysis sum;
 define resamt / 'Total' analysis sum;
 break after stname / skip summarize ol suppress;
 break after year / page summarize dul dol suppress;
 format resn comma5. resamt dollar14.;
run;
```

Note: The BREAK statement will be covered in the next section.

Sample 3

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	University	Research Grants N	Research Grants Total
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	26	$7,097,448
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	134	$32,118,502
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	14	$4,904,997
			174	$44,120,947
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	560	$181,608,047
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	221	$47,330,824
			781	$228,938,871
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	18	$3,472,404
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	178	$41,466,312
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	141	$33,955,259
			337	$78,893,975
			1,292	$351,953,793

Sample 3

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	University	Research Grants N	Research Grants Total
1997	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	27	$7,015,966
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	140	$33,651,458
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	15	$6,569,248
			182	$47,236,672
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	579	$187,473,322
		U S UNIFORMED SERVICES UNIV HLTH SCIS	1	$97,773
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	237	$50,614,013
			817	$238,185,108
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	16	$3,248,901
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	208	$47,942,379
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	133	$34,256,198
			357	$85,447,478
			1,356	$370,869,258

The BREAK Statement

Produces a summary line when the value of an order or group variable changes.

BREAK *location var / options*;

location	placement of break lines: AFTER, BEFORE
var	order or group variable
options	this is a partial list of the options
	DOL for double overlining
	DUL for double underlining
	OL for single overlining
	UL for single underlining

The BREAK Statement

SKIP	skips a line after each group
PAGE	starts a new page after each group
SUMMARIZE	writes a summary line for each group
SUPPRESS	suppresses value and lines of the break variable in summary line

Examples: In **sample 3** we use two BREAK statements

```
break after stname / skip summarize ol suppress;
break after year / page;
```

The RBREAK Statement

Produces a summary line at the beginning or end of a report.

RBREAK *location* / *options*;

location placement of break lines: AFTER, BEFORE

options this is a partial list of the options

DOL	for double overlining
DUL	for double underlining
OL	for overlining
UL	for underlining
SKIP	skips a line after a break line located at beginning of the report
SUMMARIZE	writes summary line

The RBREAK Statement

Example:

```
proc report data=rep.awards nowd headskip headline;
 column year stname resn resamt;
 define year / 'Year' group;
 define stname / 'State' group;
 define resn / 'Number/Awards' analysis sum f=comma6.;
 define resamt / 'Total/Amount' analysis sum f=dollar13.;
 break after year / skip summarize ol;
 rbreak before / summarize dul skip;
run;
```

The RBREAK Statement

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Number Awards	Total Amount
		2,648	$722,823,051
1996	DIST OF COL	174	$44,120,947
	MARYLAND	781	$228,938,871
	VIRGINIA	337	$78,893,975
1996		1,292	$351,953,793
1997	DIST OF COL	182	$47,236,672
	MARYLAND	817	$238,185,108
	VIRGINIA	357	$85,447,478
1997		1,356	$370,869,258

Group Variable

Group variables are used to consolidate into one row all observations that have a unique combination of values.

In **sample 4** YEAR and STNAME are group variables.

```
proc report data=rep.awards nowd headskip headline;
 column year stname resn resamt;
 define year / 'Year' group;
 define stname / 'State' group;
 define resn / 'Number/Awards' analysis sum;
 define resamt / 'Total/Amount' analysis sum;
 break after year / skip;
 format resamt dollar13.;
run;
```

Sample 4

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Number Awards	Total Amount
1996	DIST OF COL	174	$44,120,947
	MARYLAND	781	$228,938,871
	VIRGINIA	337	$78,893,975
1997	DIST OF COL	182	$47,236,672
	MARYLAND	817	$238,185,108
	VIRGINIA	357	$85,447,478

Multiple Statistics

There are various ways of requesting multiple statistics for the same group variable.

Example 1:

```
proc report data=rep.awards nowd headskip headline;
 column year stname resamt,(min max);
 define year / 'Year' group;
 define stname / 'State' group;
 define resamt / ' ';
 define min / 'Minimum' f=dollar12.;
 define max / 'Maximum' f=dollar12.;
 break after year / skip;
run;
```

Multiple Statistics

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia
Minimum and Maximum Any University Received

Year	State	Minimum	Maximum
1996	DIST OF COL	$4,904,997	$32,118,502
	MARYLAND	$47,330,824	$181,608,047
	VIRGINIA	$3,472,404	$41,466,312
1997	DIST OF COL	$6,569,248	$33,651,458
	MARYLAND	$97,773	$187,473,322
	VIRGINIA	$3,248,901	$47,942,379

Multiple Statistics

Example 2: Sample 5 produces the same results.

```
proc report data=rep.awards nowd headskip headline;
 column year stname resamt=resmin resamt=resmax;
 define year / 'Year' group;
 define stname / 'State' group;
 define resmin / 'Minimum' analysis min f=dollar12.;
 define resmax / 'Maximum' analysis max f=dollar12.;
 break after year / skip;
run;
```

Workshop 1

For all the exercises in all the workshops use the data set AWARDS that is saved in the folder c:\awards.

Before beginning the exercises enter and submit the following statements:

```
libname rep 'c:\awards';
```

You may want to save your programs in the folder c:\awards since you will need to modify some later.

Exercise 1:

Create the report shown below. All observations should appear in the report.

NIH Fellowship, Research and Training Awards

Year	State	University	Fellowship	Research	Training
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	$136,783	$7,097,448	$0
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	$246,684	$32,118,502	$461,360
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	$70,948	$4,904,997	$623,425
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	$1,624,258	$181,608,047	$8,795,463
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	$276,044	$47,330,824	$878,818
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	$48,626	$3,472,404	$0
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	$622,612	$41,466,312	$2,442,739
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	$221,020	$33,955,259	$1,253,788
1997	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	$126,803	$7,015,966	$0
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	$340,851	$33,651,458	$884,139
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	$30,289	$6,569,248	$332,227
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	$1,476,525	$187,473,322	$9,478,438
		U S UNIFORMED SERVICES UNIV HLTH SCIS	$0	$97,773	$0
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	$360,007	$50,614,013	$1,369,113
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	$16,718	$3,248,901	$0
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	$618,832	$47,942,379	$2,783,142
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	$233,707	$34,256,198	$1,007,380

Exercise 2:

Modify the program from exercise 1 as follows:

- each year should be in a separate page
- include a summary line after each state and after each year

This is the report for 1996:

NIH Fellowship, Research and Training Awards

Year	State	University	Fellowship	Research	Training
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	$136,783	$7,097,448	$0
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	$246,684	$32,118,502	$461,360
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	$70,948	$4,904,997	$623,425
			$454,415	$44,120,947	$1,084,785
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	$1,624,258	$181,608,047	$8,795,463
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	$276,044	$47,330,824	$878,818
			$1,900,302	$228,938,871	$9,674,281
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	$48,626	$3,472,404	$0
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	$622,612	$41,466,312	$2,442,739
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	$221,020	$33,955,259	$1,253,788
			$892,258	$78,893,975	$3,696,527
			$3,246,975	$351,953,793	$14,455,593

Exercise 3:

Create the following report. It is similar to exercise 2 but only includes the summary lines and excludes the university names.

NIH Fellowship, Research and Training Awards

Year	State	Fellowship	Research	Training
1996	DIST OF COL	$454,415	$44,120,947	$1,084,785
	MARYLAND	$1,900,302	$228,938,871	$9,674,281
	VIRGINIA	$892,258	$78,893,975	$3,696,527
		$3,246,975	$351,953,793	$14,455,593
1997	DIST OF COL	$497,943	$47,236,672	$1,216,366
	MARYLAND	$1,836,532	$238,185,108	$10,847,551
	VIRGINIA	$869,257	$85,447,478	$3,790,522
		$3,203,732	$370,869,258	$15,854,439

Exercise 4:

Modify the program from exercise 3 so the report shows the maximum amounts granted to a state. The report should look like this:

NIH Fellowship, Research and Training Awards
Maximum Amounts Granted

Year	State	Fellowship	Research	Training
1996	DIST OF COL	$246,684	$32,118,502	$623,425
	MARYLAND	$1,624,258	$181,608,047	$8,795,463
	VIRGINIA	$622,612	$41,466,312	$2,442,739
		$1,624,258	$181,608,047	$8,795,463
1997	DIST OF COL	$340,851	$33,651,458	$884,139
	MARYLAND	$1,476,525	$187,473,322	$9,478,438
	VIRGINIA	$618,832	$47,942,379	$2,783,142
		$1,476,525	$187,473,322	$9,478,438

Exercise 5:

Now, create a report that includes both the total amounts granted and the maximums as shown here:

NIH Fellowship, Research and Training Awards
Total and Maximum Amount Granted

		Fellowship		Research		Training	
Year	State	Total	Maximum	Total	Maximum	Total	Maximum
1996	DIST OF COL	$454,415	$246,684	$44,120,947	$32,118,502	$1,084,785	$623,425
	MARYLAND	$1,900,302	$1,624,258	$228,938,871	$181,608,047	$9,674,281	$8,795,463
	VIRGINIA	$892,258	$622,612	$78,893,975	$41,466,312	$3,696,527	$2,442,739
		$3,246,975	$1,624,258	$351,953,793	$181,608,047	$14,455,593	$8,795,463
1997	DIST OF COL	$497,943	$340,851	$47,236,672	$33,651,458	$1,216,366	$884,139
	MARYLAND	$1,836,532	$1,476,525	$238,185,108	$187,473,322	$10,847,551	$9,478,438
	VIRGINIA	$869,257	$618,832	$85,447,478	$47,942,379	$3,790,522	$2,783,142
		$3,203,732	$1,476,525	$370,869,258	$187,473,322	$15,854,439	$9,478,438

Across Variable

A column is created for each value of an across variable.

Example 1: In this example YEAR is an across variable.

```
proc report data=rep.awards nowd headskip headline;
 column stname year,(resn resamt);
 define year / ' ' across;
 define stname / 'State' group width=11;
 define resn / '/Number/Awards';
 define resamt / '/Total/Amount';
 format resamt dollar14.;
run;
```

Across Variable

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

	1996		1997	
State	Number Awards	Total Amount	Number Awards	Total Amount
DIST OF COL	174	$44,120,947	182	$47,236,672
MARYLAND	781	$228,938,871	817	$238,185,108
VIRGINIA	337	$78,893,975	357	$85,447,478

Across Variable

Example 2: In **sample 6** we assign a format to YEAR to add lines on each side of the year.

```
proc format;
 value yr 1996='_1996_' 1997='_1997_';
run;

proc report data=rep.awards nowd headskip headline;
 column stname year,(resn resamt);
 define year / ' ' across;
 define stname / 'State' group width=11;
 define resn / '/Number/Awards';
 define resamt / '/Total/Amount';
 format resamt dollar14. year yr.;
run;
```

Sample 6

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

	1996		1997	
State	Number Awards	Total Amount	Number Awards	Total Amount
DIST OF COL	174	$44,120,947	182	$47,236,672
MARYLAND	781	$228,938,871	817	$238,185,108
VIRGINIA	337	$78,893,975	357	$85,447,478

Computed Variable

These are variables you create in PROC REPORT to display them in the report. You need to:

- include the variable in the COLUMN statement
- define the usage as COMPUTED
- use a COMPUTE block to compute the values

Computed Variable

The variables you need to calculate a new variable must be included in the COLUMN statement even if you don't want to display them. If you don't want them displayed use the NOPRINT option in the corresponding DEFINE statements.

A computed variable can only depend on the variables to its left in the COLUMN statement.

Computed Variable

Example 1:

```
proc report data=rep.awards nowd headskip headline;
 column year stname univname conn feln resn tran
        othn total;
 define year / 'Year' order;
 define stname / 'State' order;
 define univname / 'University' order;
 define conn / display noprint;
 define feln / display noprint;
 define resn / display noprint;
 define tran / display noprint;
 define othn / display noprint;
 define total / 'Number of/Awards' computed center
                width=9 format=4.;
 compute total;
   total=conn+feln+resn+tran+othn;
 endcomp;
run;
```

Computed Variable

Total NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	University	Number of Awards
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	35
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	159
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	19
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	681
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	250
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	21
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	215
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	165
1997	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	34
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	168
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	20
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	687
		U S UNIFORMED SERVICES UNIV HLTH SCIS	2
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	269
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	18
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	246
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	152

Computed Variable

Example 2: In **sample 7** the variable TOTAL is a computed variable.

```
proc report data=rep.awards nowd headskip;
 column year stname conn feln resn tran othn total;
 define year / 'Year' group width=4;
 define stname / 'State' group width=11;
 define conn / 'Contracts' width=11;
 define feln / 'Fellowships' width=11;
 define resn / 'Research' width=11;
 define tran / 'Training' width=11;
 define othn / 'Other' width=11;
 define total / 'Total' computed format=comma11.;
 break after year / skip summarize ol suppress;
 compute total;
   total=conn.sum + feln.sum + resn.sum + tran.sum + othn.sum;
 endcomp;
 format conn feln resn tran othn comma5.;
run;
```

Computed Variable

The item **conn.sum** is called a **compound name**. A compound name is of the form: *variable.statistic*

It contains the statistic that PROC REPORT calculates for that variable.

Sample 7

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Contracts	Fellowships	Research	Training	Other	Total
1996	DIST OF COL	14	18	174	6	1	213
	MARYLAND	25	68	781	54	3	931
	VIRGINIA	6	33	337	24	1	401
		fffffffffff	*fffffffffff*	*fffffffffff*	*fffffffffff*	*fffffffffff*	*fffffffffff*
		45	119	1,292	84	5	1,545
1997	DIST OF COL	13	19	182	8	0	222
	MARYLAND	21	63	817	54	3	958
	VIRGINIA	6	31	357	20	2	416
		fffffffffff	*fffffffffff*	*fffffffffff*	*fffffffffff*	*fffffffffff*	*fffffffffff*
		40	113	1,356	82	5	1,596

Compute Blocks

A compute block contains one or more statements that are executed as the report is built. It starts with a COMPUTE statement and must end with an ENDCOMP statement.

You can include some DATA step statements in compute blocks:

assignment	DO	END
IF-THEN/ELSE	SELECT	sum

Compute Blocks

There are two types of compute blocks:

First type: Associate the compute block with a column

```
COMPUTE report_item / type-specification;
 statements
 CALL DEFINE(column-id,'attribute',value);
ENDCOMP;
```

report_item	a data set variable, a computed variable, or a statistic to associate the block with
type-specification	computed variables are assumed to be numeric. If it is character you must use the option CHARACTER and, optionally, the LENGTH= option (default: 8).

Compute Blocks

column-id	column name or column number. _C*n*_ indicates column number *n*. _COL_ indentifies the column that is attached to the compute block.
attribute	in the nonwindowing environment it can only be “format”
value	value for the attribute (e.g. comma11.)

Compute Blocks

Example 1:

```
proc report data=rep.awards nowd headskip;
 column year stname conn feln resn tran othn total s;
 define year / 'Year' group width=4;
 define stname / 'State' group width=11;
 define conn / 'Contracts' width=11;
 define feln / 'Fellowships' width=11;
 define resn / 'Research' width=11;
 define tran / 'Training' width=11;
 define othn / 'Other' width=11;
 define total / 'Total' computed width=11;
 define s / ' ' computed width=4;
 compute total;
   total=conn.sum + feln.sum + resn.sum +
         tran.sum + othn.sum;
   call define(_col_,"format","comma11.");
 endcomp;
 compute s / character length=4;
   if total > 500 then s='>500';
   else s=' ';
 endcomp;
 break after year / skip;
 format conn feln resn tran othn comma5.;
run;
```

Compute Blocks

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Contracts	Fellowships	Research	Training	Other	Total	
1996	DIST OF COL	14	18	174	6	1	213	
	MARYLAND	25	68	781	54	3	931	>500
	VIRGINIA	6	33	337	24	1	401	
1997	DIST OF COL	13	19	182	8	0	222	
	MARYLAND	21	63	817	54	3	958	>500
	VIRGINIA	6	31	357	20	2	416	

Compute Blocks

Example 2:

```
proc report data=rep.awards nowd headskip headline;
 column stname year,(resn resamt)
        ('_Grand Total_' tresn tresamt);
 define year / ' ' across f=yr.;
 define stname / 'State' group width=11;
 define resn / '/Number/Awards' width=6 spacing=6;
 define resamt / '/Total/Amount' f=dollar12.;
 define tresn / '/Number/Awards' computed f=comma6. spacing=6;
 define tresamt / '/Total/Amount' computed f=dollar12.;
 compute tresn;
   tresn=_c2_+_c4_;
 endcomp;
 compute tresamt;
   tresamt=_c3_+_c5_;
 endcomp;
run;
```

Compute Blocks

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

	1996		1997		Grand Total	
State	Number Awards	Total Amount	Number Awards	Total Amount	Number Awards	Total Amount
DIST OF COL	174	$44,120,947	182	$47,236,672	356	$91,357,619
MARYLAND	781	$228,938,871	817	$238,185,108	1,598	$467,123,979
VIRGINIA	337	$78,893,975	357	$85,447,478	694	$164,341,453

Compute Blocks

Second type: Associate the compute block with a location and, optionally, a break variable

```
COMPUTE location <break-var>;
  LINE specifications;
  other statements;
ENDCOMP;
```

location	where compute block executes: AFTER, BEFORE
break-var	(optional) a group or order variable

Compute Blocks

Example: This is a modified version of sample 4. Here we use a COMPUTE AFTER.

```
proc report data=rep.awards nowd headskip headline;
 column year stname resn resamt;
 define year / 'Year' group;
 define stname / 'State' group;
 define resn / 'Number/Awards';
 define resamt / 'Total/Amount';
 break after year / skip;
 compute after;
   line 'The total amount awarded from 1996 to 1997 is'
         resamt.sum dollar13. '.';
 endcomp;
 format resamt dollar13.;
run;
```

Note: The LINE statement will be covered in the next section.

Compute Blocks

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Number Awards	Total Amount
1996	DIST OF COL	174	$44,120,947
	MARYLAND	781	$228,938,871
	VIRGINIA	337	$78,893,975
1997	DIST OF COL	182	$47,236,672
	MARYLAND	817	$238,185,108
	VIRGINIA	357	$85,447,478

The total amount awarded from 1996 to 1997 is $722,823,051.

LINE Statement

Is a subset of the PUT statement. It can only be used with compute blocks that are associated with a location in the report.

It cannot be used in conditional statements.

LINE *specifications*;

specifications can be any of the following:

item	data set variable, computed variable, statistic in the report
format	format for variable
'character string'	string of text
@n	specifies the number of the column in which to start writing the item following it
+n	specifies the number of columns to skip before writing the next item

Workshop 2

Exercise 1:

Create a report that shows the total amount granted for Training Awards for each state for each year. The year should be shown across the page. The report would look like this:

NIH Training Awards
Amounts Granted

State	Year 1996	1997
DIST OF COL	$1,084,785	$1,216,366
MARYLAND	$9,674,281	$10,847,551
VIRGINIA	$3,696,527	$3,790,522

Exercise 2:

Modify the program from exercise 1 so it also includes a column for the percent increase from 1996 to 1997. Here is the report:

NIH Training Awards
Amounts Granted

State	Year 1996	1997	Percent Increase
DIST OF COL	$1,084,785	$1,216,366	12.13%
MARYLAND	$9,674,281	$10,847,551	12.13%
VIRGINIA	$3,696,527	$3,790,522	2.54%

Note: To display percent signs use the PERCENTw.d format where “w” represents the total width and “d” is the number of decimal digits (0 or 2). When you use this format the value is first multiplied by 100. Then the value is formatted using the w.d format and a % sign is added to the end. If the value is negative, parenthesis are added. Allow enough room for all the digits, the % sign and the parenthesis even if the value is not negative. For example, to display the value 100.00% use the format PERCENT9.2.

Exercise 3:

Modify the program from exercise 1 in workshop 1 so it includes a column for the total amount granted for Fellowship, Research and Training awards.

NIH Fellowship, Research and Training Awards

Year	State	University	Fellowship	Research	Training	Total
1996	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	$136,783	$7,097,448	$0	$7,234,231
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	$246,684	$32,118,502	$461,360	$32,826,546
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	$70,948	$4,904,997	$623,425	$5,599,370
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	$1,624,258	$181,608,047	$8,795,463	$192,027,768
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	$276,044	$47,330,824	$878,818	$48,485,686
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	$48,626	$3,472,404	$0	$3,521,030
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	$622,612	$41,466,312	$2,442,739	$44,531,663
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	$221,020	$33,955,259	$1,253,788	$35,430,067
1997	DIST OF COL	GEORGE WASHINGTON UNIV SCH OF MEDICINE	$126,803	$7,015,966	$0	$7,142,769
		GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	$340,851	$33,651,458	$884,139	$34,876,448
		HOWARD UNIVERSITY COLLEGE OF MEDICINE	$30,289	$6,569,248	$332,227	$6,931,764
	MARYLAND	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	$1,476,525	$187,473,322	$9,478,438	$198,428,285
		U S UNIFORMED SERVICES UNIV HLTH SCIS	$0	$97,773	$0	$97,773
		UNIVERSITY OF MARYLAND SCH OF MEDICINE	$360,007	$50,614,013	$1,369,113	$52,343,133
	VIRGINIA	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	$16,718	$3,248,901	$0	$3,265,619
		UNIVERSITY OF VIRGINIA SCH OF MEDICINE	$618,832	$47,942,379	$2,783,142	$51,344,353
		VIRGINIA COMMONWEALTH UNIV MED COL OF VA	$233,707	$34,256,198	$1,007,380	$35,497,285

Missing Data

By default, PROC REPORT ignores observations with a missing value for any group, order or across variables that appear in the report.

To consider missing values as valid values use the MISSING option in the PROC REPORT statement.

Here we add one observation where the state name is missing.

```
data awmiss;
 set rep.awards end=e; output;
 if e=1 then do;
   year=1996; stname=' '; resn=20; resamt=500000;
   output;
 end;
run;
```

Missing Data

```
*without missing option;
proc report data=awmiss nowd headskip headline;
 column year stname resn resamt;
 define year / 'Year' group;
 define stname / 'State' group;
 define resn / 'Number/Awards' f=comma6.;
 define resamt / 'Total/Amount' f=dollar13.;
 break after year / skip summarize suppress ol;
 rbreak after / dol summarize;
run;

*with missing option;
proc report data=awmiss nowd headskip headline missing;
 column year stname resn resamt;
 define year / 'Year' group;
 define stname / 'State' group;
 define resn / 'Number/Awards' f=comma6.;
 define resamt / 'Total/Amount' f=dollar13.;
 break after year / skip summarize suppress ol;
 rbreak after / dol summarize;
run;
```

Missing Data

Without MISSING Option

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Number Awards	Total Amount
1996	DIST OF COL	174	$44,120,947
	MARYLAND	781	$228,938,871
	VIRGINIA	337	$78,893,975
		1,292	$351,953,793
1997	DIST OF COL	182	$47,236,672
	MARYLAND	817	$238,185,108
	VIRGINIA	357	$85,447,478
		1,356	$370,869,258
		2,648	$722,823,051

With MISSING Option

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Number Awards	Total Amount
1996		20	$500,000
	DIST OF COL	174	$44,120,947
	MARYLAND	781	$228,938,871
	VIRGINIA	337	$78,893,975
		1,312	$352,453,793
1997	DIST OF COL	182	$47,236,672
	MARYLAND	817	$238,185,108
	VIRGINIA	357	$85,447,478
		1,356	$370,869,258
		2,668	$723,323,051

How a Report is Built

1. If necessary, the data is consolidated by group, order and across variables.

2. All report statistics are calculated, including those for the summary lines. All this information is stored in a temporary file.

3. All **DATA step variables** are initialized to missing. These are variables that are created in compute blocks but not displayed in the report.

4. One at a time, each row is built and displayed:
   a. **report variables** (all variables that are displayed in the report) are initialized to missing.

How a Report is Built

b. values are filled in from left to right. Computed variables are calculated using their respective compute blocks. Other values are obtained from the temporary file that was created at the beginning of the process.

c. at a break, PROC REPORT builds the break lines created with the BREAK or RBREAK statements then executes their respective compute blocks if any exist.

How a Report is Built

Suppose you want a report like the one below with a percent column that shows the percentage of research awards granted to a state for each year separately.

NIH Research Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	N	Percent
1996	DIST OF COL	174	13.47%
	MARYLAND	781	60.45%
	VIRGINIA	337	26.08%
		1,292	100.00%
1997	DIST OF COL	182	13.42%
	MARYLAND	817	60.25%
	VIRGINIA	357	26.33%
		1,356	100.00%

How a Report is Built

This progam will display that report. An explanation follows in the next pages.

```
proc report data=rep.awards nowd headskip headline;
 column year stname resn respct;
 define year / 'Year' group;
 define stname / 'State' group;
 define resn / 'N' f=comma5.;
 define respct / 'Percent' computed center f=percent9.2;
 break after year / skip summarize ol suppress;
 compute before year;
   resntot=resn.sum;
 endcomp;
 compute respct;
   respct=resn.sum/resntot;
 endcomp;
run;
```

How a Report is Built

In the program we create a variable called RESPCT that will contain the percentage. In the COMPUTE RESPCT block we need to divide the total number of research awards for a state by the total number of research awards for that year.

It is important to note that the value of RESN.SUM has different meanings in different lines of the report. In detail lines it represents the number of research awards for that state for that year. In the summary line it represents the number of research awards for that year. These are the two values we need to divide to obtain the percentage.

How a Report is Built

We need to retain the value of RESN.SUM for the year **before** PROC REPORT calculates each detail line since that is the denominator for calculating RESPCT. To achieve this we use the COMPUTE BEFORE YEAR block which retrieves the value of RESN.SUM for a year and saves it in the DATA step variable RESNTOT.

Later, when PROC REPORT calculates the values of RESPCT, the variable RESNTOT is used as the denominator.

Modifying the Data to Get the Report you Want

Suppose you want a report like the one below for each year. Can it be done with the data set as it is saved?

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Award Type	N	Amount
1996	DIST OF COL	Research	174	44,120,947
		Training	6	1,084,785
		Contracts	14	6,568,339
		Fellowships	18	454,415
		Other	1	734,544
			213	$52,963,030
	MARYLAND	Research	781	228,938,871
		Training	54	9,674,281
		Contracts	25	14,249,751
		Fellowships	68	1,900,302
		Other	3	1,574,112
			931	$256,337,317
	VIRGINIA	Research	337	78,893,975
		Training	24	3,696,527
		Contracts	6	1,649,995
		Fellowships	33	892,258
		Other	1	132,978
			401	$85,265,733
			1,545	$394,566,080

Modifying the Data to Get the Report you Want

The format of the data set needs to be changed. The following DATA step creates the data set TYPES that is saved differently. For each observation in AWARDS it creates five observations, one for each type of award.

```
data types;
 set rep.awards;
 array amtaward(5) resamt traamt conamt felamt othamt;
 array naward(5) resn tran conn feln othn;
 do type=1 to 5;
   amount=amtaward(type);
   num=naward(type);
   output;
 end;
 keep stname year type amount num;
run;
```

Modifying the Data to Get the Report you Want

First 20 observations of data set TYPES

Obs	STNAME	YEAR	TYPE	AMOUNT	NUM
1	MARYLAND	1996	1	181608047	560
2	MARYLAND	1996	2	8795463	44
3	MARYLAND	1996	3	10304633	17
4	MARYLAND	1996	4	1624258	57
5	MARYLAND	1996	5	1574112	3
6	MARYLAND	1996	1	47330824	221
7	MARYLAND	1996	2	878818	10
8	MARYLAND	1996	3	3945118	8
9	MARYLAND	1996	4	276044	11
10	MARYLAND	1996	5	0	0
11	VIRGINIA	1996	1	41466312	178
12	VIRGINIA	1996	2	2442739	14
13	VIRGINIA	1996	3	0	0
14	VIRGINIA	1996	4	622612	22
15	VIRGINIA	1996	5	132978	1
16	DIST OF COL	1996	1	32118502	134
17	DIST OF COL	1996	2	461360	4
18	DIST OF COL	1996	3	5288387	11
19	DIST OF COL	1996	4	246684	10
20	DIST OF COL	1996	5	0	0

Compare to the original data set. 

Modifying the Data to Get the Report you Want

```
proc format;
 value atype 1='Research'  2='Training'
             3='Contracts' 4='Fellowships' 5='Other';
run;

proc report data=types nowd headline headskip;
 column year stname type num amount;
 define year   / 'Year' group;
 define stname / 'State' group;
 define type   / 'Award Type' group order=internal f=atype.;
 define num    / 'N' analysis sum f= comma5.;
 define amount / 'Amount' f=comma12.;
 break after stname / skip;
 break after year  / page summarize suppress dul dol;
 compute amount;
   if year=. and stname=' ' and type=. then
      call define(_col_,"format","dollar12.");
 endcomp;
run;
```

Multiple Panels per Page

The PANELS= option produces several panels per page as shown below. The option is used in the PROC REPORT statement.

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Award Type	N	Year	State	Award Type	N
1996	DIST OF COL	Research	174	1997	DIST OF COL	Research	182
		Training	6			Training	8
		Contracts	14			Contracts	13
		Fellowships	18			Fellowships	19
		Other	1			Other	0
	MARYLAND	Research	781		MARYLAND	Research	817
		Training	54			Training	54
		Contracts	25			Contracts	21
		Fellowships	68			Fellowships	63
		Other	3			Other	3
	VIRGINIA	Research	337		VIRGINIA	Research	357
		Training	24			Training	20
		Contracts	6			Contracts	6
		Fellowships	33			Fellowships	31
		Other	1			Other	2

Multiple Panels per Page

```
proc report data=types nowd headline headskip
             panels=2 ps=21;
 column year stname type num;
 define year   / 'Year' group;
 define stname / 'State' group;
 define type   / 'Award Type' group order=internal;
 define num    / 'N'  analysis sum;
 format type atype.;
run;
```

Displaying Computed Variable Before Variables it Uses

Computed variables can only depend on variables to the left of it. Here is an example of what you can do to override this restriction.

```
proc report data=rep.awards nowd headskip headline;
 column year univname total conn feln resn tran othn;
 define year / 'Year' group width=4;
 define univname / 'University' group;
 define conn / 'Contracts' width=11;
 define feln / 'Fellowships' width=11;
 define resn / 'Research' width=11;
 define tran / 'Training' width=11;
```

(continued on next page)

Displaying Computed Variable Before Variables it Uses

(continuation)

```
 define othn / 'Other' width=11;
 define total / 'Number of/Awards' computed center
                width=9 format=4.;
 compute before univname;
   tot=conn.sum+feln.sum+resn.sum+tran.sum+othn.sum;
 endcomp;
 compute total;
   total=tot;
 endcomp;
 break after year / skip;
run;
```

Displaying Computed Variable Before Variables it Uses

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	University	Number of Awards	Contracts	Fellowships	Research	Training	Other
1996	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	21	1	2	18	0	0
	GEORGE WASHINGTON UNIV SCH OF MEDICINE	35	2	6	26	0	1
	GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	159	11	10	134	4	0
	HOWARD UNIVERSITY COLLEGE OF MEDICINE	19	1	2	14	2	0
	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	681	17	57	560	44	3
	UNIVERSITY OF MARYLAND SCH OF MEDICINE	250	8	11	221	10	0
	UNIVERSITY OF VIRGINIA SCH OF MEDICINE	215	0	22	178	14	1
	VIRGINIA COMMONWEALTH UNIV MED COL OF VA	165	5	9	141	10	0
1997	EASTERN VIRGINIA MED/SCH MED COL HAMP RD	18	1	1	16	0	0
	GEORGE WASHINGTON UNIV SCH OF MEDICINE	34	3	4	27	0	0
	GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE	168	8	14	140	6	0
	HOWARD UNIVERSITY COLLEGE OF MEDICINE	20	2	1	15	2	0
	JOHNS HOPKINS UNIVERSITY SCH OF MEDICINE	687	15	50	579	42	1
	U S UNIFORMED SERVICES UNIV HLTH SCIS	2	0	0	1	0	1
	UNIVERSITY OF MARYLAND SCH OF MEDICINE	269	6	13	237	12	1
	UNIVERSITY OF VIRGINIA SCH OF MEDICINE	246	0	22	208	14	2
	VIRGINIA COMMONWEALTH UNIV MED COL OF VA	152	5	8	133	6	0

Workshop 3

Exercise 1:

Create the following report. You will need to modify the data like we did in class. Calculate the column “Average” in the PROC REPORT. Verify that the average values are correct.

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	Award Type	N	Total	Average
1996	Research	1,292	351,953,793	272,410
	Training	84	14,455,593	172,090
	Contracts	45	22,468,085	499,291
	Fellowships	119	3,246,975	27,286
	Other	5	2,441,634	488,327
1997	Research	1,356	370,869,258	273,502
	Training	82	15,854,439	193,347
	Contracts	40	23,097,510	577,438
	Fellowships	113	3,203,732	28,352
	Other	5	729,383	145,877

Exercise 2:

Modify exercise 1 so it also includes a column that illustrates the percentage granted to each type of award for each year separately. Here is the report:

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	Award Type	N	Total	Average	Percent
1996	Research	1,292	351,953,793	272,410	89.20
	Training	84	14,455,593	172,090	3.66
	Contracts	45	22,468,085	499,291	5.69
	Fellowships	119	3,246,975	27,286	0.82
	Other	5	2,441,634	488,327	0.62
1997	Research	1,356	370,869,258	273,502	89.64
	Training	82	15,854,439	193,347	3.83
	Contracts	40	23,097,510	577,438	5.58
	Fellowships	113	3,203,732	28,352	0.77
	Other	5	729,383	145,877	0.18

Exercise 3:

Modify exercise 1 so the Average column is displayed before the N and Total columns.

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	Award Type	Average	N	Total
1996	Research	272,410	1,292	351,953,793
	Training	172,090	84	14,455,593
	Contracts	499,291	45	22,468,085
	Fellowships	27,286	119	3,246,975
	Other	488,327	5	2,441,634
1997	Research	273,502	1,356	370,869,258
	Training	193,347	82	15,854,439
	Contracts	577,438	40	23,097,510
	Fellowships	28,352	113	3,203,732
	Other	145,877	5	729,383

Saving a Report Definition

You can save a report definition by using the OUTREPT= option in the PROC REPORT statement. To suppress the display of the report use the NOEXEC option also.

The OUTREPT= option specifies the catalog entry where the report definition will be saved. It takes a three part name:

libref.catname.entry_name

libref	libref specified in LIBNAME statement
catname	catalog name
entry_name	an entry name, i.e. the name for the report definition

Saving a Report Definition

Here we modify sample 7 to save the report definition permanently:

```
libname repdef 'c:\awards';

title  'NIH Awards Granted to Medical Schools';
title2 'District of Columbia, Maryland and Virginia';

proc report data=rep.awards nowd headskip headline
            outrept=repdef.reports.report1 noexec;
 column year stname conn feln resn tran othn total;
 define year / 'Year' group width=4;
 define stname / 'State' group width=11;
 define conn / 'Contracts' width=11;
 define feln / 'Fellowships' width=11;
define resn / 'Research' width=11;
 define tran / 'Training' width=11;
 define othn / 'Other' width=11;
 define total / 'Total' computed width=11 f=comma11.;
 break after year / skip summarize ol suppress;
 compute total;
   total=conn.sum+feln.sum+resn.sum+tran.sum+othn.sum;
 endcomp;
 format conn feln resn tran othn comma5.;
run;
```

Using a Report Definition

To use a report definition use the REPORT= option in the PROC REPORT statement to point to the entry containing the report.

To view the statements that creates the report use the LIST option in the PROC statement. The statements will be displayed in the SAS log.

```
libname repdef 'c:\awards';

title  '1998 NIH Awards Granted to Medical Schools';
title2 'District of Columbia, Maryland and Virginia';

proc report data=rep.awards98 nowd
            report=repdef.reports.report1;
run;
```

Using a Report Definition

1998 NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Year	State	Contracts	Fellowships	Research	Training	Other	Total
1998	DIST OF COL	15	19	173	6	0	213
	MARYLAND	22	53	824	53	4	956
	VIRGINIA	5	35	381	22	2	445
		42	107	1,378	81	6	1,614

Saving the Results in a SAS Data Set

You can save the results of the procedure in a SAS data set by using the OUT= option in the PROC REPORT statement.

```
proc report data=rep.awards nowd headskip headline
            out=rep.report1;
 column year stname conn feln resn tran othn total;
 define year / 'Year' group width=4;
 define stname / 'State' group width=11;
 define conn / 'Contracts' width=11;
 define feln / 'Fellowships' width=11;
 define resn / 'Research' width=11;
 define tran / 'Training' width=11;
 define othn / 'Other' width=11;
 define total / 'Total' computed width=11 f=comma11.;
 break after year / skip summarize ol suppress;
 compute total;
   total=conn.sum+feln.sum+resn.sum+tran.sum+othn.sum;
 endcomp;
format conn feln resn tran othn comma5.;
run;
```

Saving the Results in a SAS Data Set

This is what the SAS data set REPORT1 looks like:

YEAR	STNAME	CONN	FELN	RESN	TRAN	OTHN	TOTAL	_BREAK_
1996	DIST OF COL	14	18	174	6	1	213	
1996	MARYLAND	25	68	781	54	3	931	
1996	VIRGINIA	6	33	337	24	1	401	
1996		45	119	1,292	84	5	1545	YEAR
1997	DIST OF COL	13	19	182	8	0	222	
1997	MARYLAND	21	63	817	54	3	958	
1997	VIRGINIA	6	31	357	20	2	416	
1997		40	113	1,356	82	5	1596	YEAR

The _PAGE_ Option (V7 & above)

The _PAGE_ option can be used in compute blocks that are associated with a location. It causes the compute block to run once for each page, either immediately after printing titles or immediately before printing footnotes.

COMPUTE *location* _PAGE_ / *justification*;

location	BEFORE or AFTER
justification	LEFT, CENTER or RIGHT

The _PAGE_ Option (V7 & above)

```
proc report data=types nowd headline headskip;
 column year stname type num;
 define year   / group noprint;
 define stname / 'State' group;
 define type   / 'Award Type' group order=internal;
 define num    / 'N' f=comma5.;
 break after stname / skip;
 break after year / page summarize dul dol suppress;
 compute before _page_ / center;
   line 'Number of Awards for Year ' year 4.;
   line ' ';
 endcomp;
 format type atype.;
run;
```

The _PAGE_ Option (V7 & above)

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Number of Awards for Year 1996

State	Award Type	N
DIST OF COL	Research	174
	Training	6
	Fellowships	18
	Contracts	14
	Other	1
MARYLAND	Research	781
	Training	54
	Fellowships	68
	Contracts	25
	Other	3
VIRGINIA	Research	337
	Training	24
	Fellowships	33
	Contracts	6
	Other	1
		1,545

The _PAGE_ Option (V7 & above)

NIH Awards Granted to Medical Schools
District of Columbia, Maryland and Virginia

Number of Awards for Year 1997

State	Award Type	N
DIST OF COL	Research	182
	Training	8
	Fellowships	19
	Contracts	13
	Other	0
MARYLAND	Research	817
	Training	54
	Fellowships	63
	Contracts	21
	Other	3
VIRGINIA	Research	357
	Training	20
	Fellowships	31
	Contracts	6
	Other	2
		1,596

Output Delivery System (V7 & above)

A new feature in version 7 that is available for all procedures is the output delivery system, or ODS. It allows you to save SAS output in many formats.

To save the results of PROC REPORT in an HTML file, include an ODS HTML statement with the BODY= option before invoking PROC REPORT. After the RUN statement add the ODS HTML statement with the CLOSE option.

You could save the reports produced by PROC REPORT in Excel by creating an HTML file first as described above then reading it with Excel.

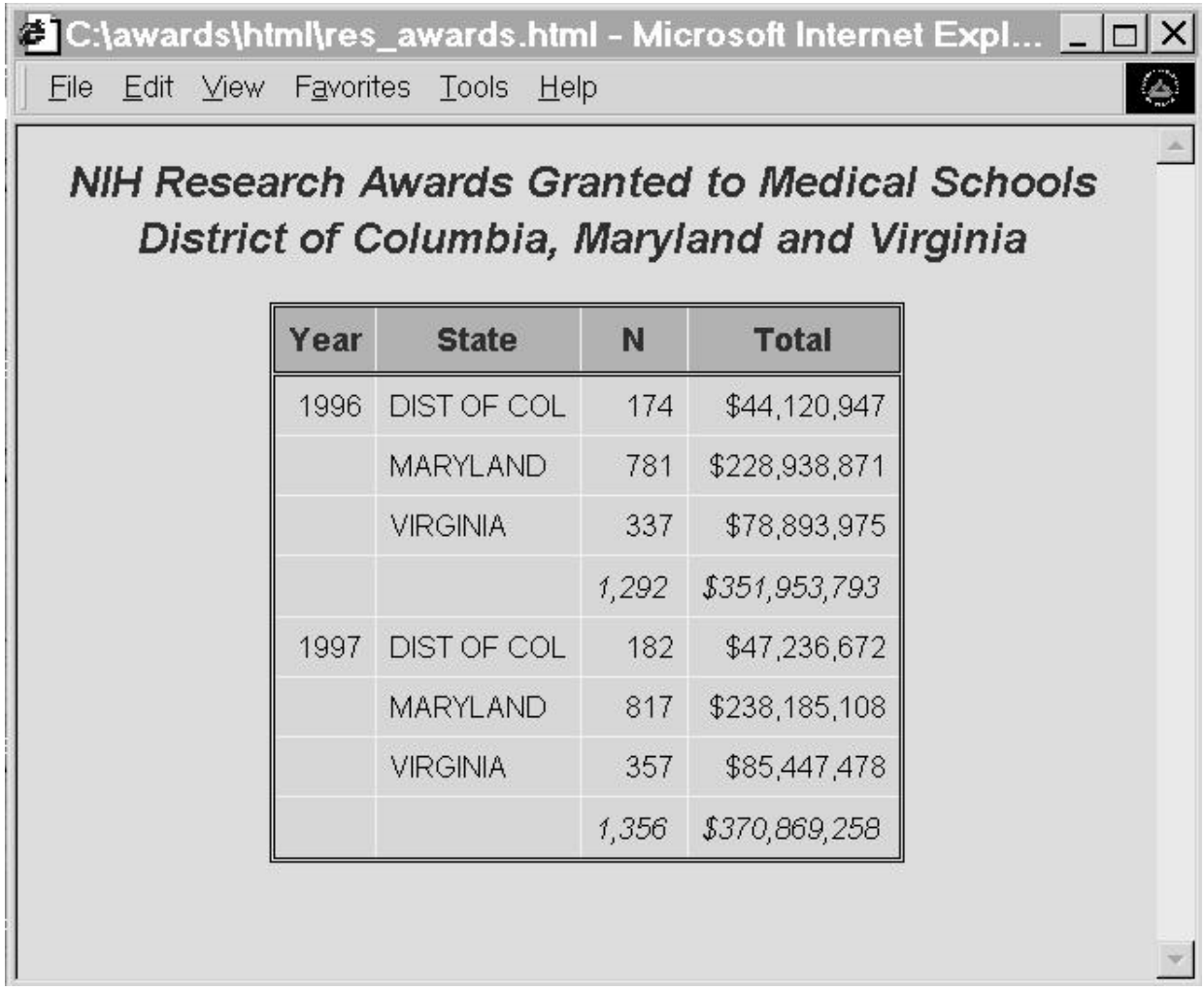
Output Delivery System (V7 & above)

```
ods html body='c:\awards\res_awards.html';

title 'NIH Research Awards Granted to Medical Schools';
title2 'District of Columbia, Maryland and Virginia';
proc report data=rep.awards nowd headskip headline;
 column year stname resn resamt;
 define year / 'Year' group;
 define stname / 'State' group;
 define resn / 'N' f=comma5.;
 define resamt / 'Total' f=dollar12.;
 break after year / skip summarize ol suppress;
run;

ods html close;
```

Output Delivery System (V7 & above)



Year	State	N	Total
1996	DIST OF COL	174	$44,120,947
	MARYLAND	781	$228,938,871
	VIRGINIA	337	$78,893,975
		1,292	*$351,953,793*
1997	DIST OF COL	182	$47,236,672
	MARYLAND	817	$238,185,108
	VIRGINIA	357	$85,447,478
		1,356	*$370,869,258*

Workshop 4

Exercise 1:

Modify exercise 5 from workshop 1 so the report definition is saved permanently in the entry:

```
rep.reports.report1
```

Exercise 2:

Use the report definition created above to obtain a report for year 1998. The set for 1998 is called **AWARDS98**. Here is the report:

NIH Fellowship, Research and Training Awards
Total and Average Amount Granted

Year: 1998

		Fellowship		Research		Training	
Year	State	Total	Maximum	Total	Maximum	Total	Maximum
1998	DIST OF COL	$433,986	$335,357	$51,886,757	$36,743,638	$1,004,978	$763,989
	MARYLAND	$1,655,884	$1,324,581	$254,942,411	$200,715,108	$11,106,154	$9,665,239
	VIRGINIA	$1,026,209	$638,819	$94,181,809	$55,229,701	$3,628,904	$2,523,083
		$3,116,079	$1,324,581	$401,010,977	$200,715,108	$15,740,036	$9,665,239

Appendix:
Workshop Answers

```
*Enter these statements before running programs;
libname rep 'c:\awards'; *classroom;
options ls=144 ps=45 nonumber nodate; *8pt,lands, 0.5" margins;

/*-------------------------------------------------
| WORKSHOP 1                                      |
 -------------------------------------------------*/
*Exercise 1;
title  'NIH Fellowship, Research and Training Awards';
proc report data=rep.awards nowd headskip headline;
 column year stname univname felamt resamt traamt;
 define year / 'Year' order;
 define stname / 'State' order;
 define univname / 'University' order;
 define felamt / 'Fellowship' format=dollar14.;
 define resamt / 'Research' format=dollar14.;
 define traamt / 'Training' format=dollar14.;
run;

*Exercise 2;
title  'NIH Fellowship, Research and Training Awards';
proc report data=rep.awards nowd headskip headline;
 column year stname univname felamt resamt traamt;
 define year / 'Year' order;
 define stname / 'State' order;
 define univname / 'University' order;
 define felamt / 'Fellowship' format=dollar14.;
 define resamt / 'Research' format=dollar14.;
 define traamt / 'Training' format=dollar14.;
 break after stname / skip summarize suppress ol;
 break after year / summarize suppress dol dul page;
run;
```

```
*Exercise 3;
title  'NIH Fellowship, Research and Training Awards';
proc report data=rep.awards nowd headskip headline;
 column year stname felamt resamt traamt;
 define year / 'Year' group;
 define stname / 'State' group;
 define felamt / 'Fellowship' format=dollar14.;
 define resamt / 'Research' format=dollar14.;
 define traamt / 'Training' format=dollar14.;
 break after year / skip summarize suppress dol;
run;

*Exercise 4;
title  'NIH Fellowship, Research and Training Awards';
title2 'Maximum Amounts Granted';
proc report data=rep.awards nowd headskip headline;
 column year stname felamt resamt traamt;
 define year / 'Year' group;
 define stname / 'State' group;
 define felamt / 'Fellowship' max format=dollar12.;
 define resamt / 'Research' max format=dollar12.;
 define traamt / 'Training' max format=dollar12.;
 break after year / skip summarize suppress dol;
run;

*Exercise 5;
title  'NIH Fellowship, Research and Training Awards';
title2 'Total and Maximum Amount Granted';
proc report data=rep.awards nowd headskip headline;
 column year stname felamt,(sum max) resamt,(sum max) traamt,(sum max);
 define year / 'Year' group;
 define stname / 'State' group;
 define felamt / 'Fellowship/--';
 define resamt / 'Research/--';
 define traamt / 'Training/--';
 define sum / 'Total' format=dollar14.;
 define max / 'Maximum' format=dollar14.;
 break after year / skip summarize suppress dol;
run;
```

```
/*-------------------------------------------------
| WORKSHOP 2                                      |
 -------------------------------------------------*/
*Exercise 1;
title  'NIH Training Awards';
title2 'Amounts Granted';
proc report data=rep.awards nowd headskip headline;
 column stname year,traamt;
 define year / 'Year/ ' across;
 define stname / 'State/ ' group;
 define traamt / ' ' format=dollar14. center;
run;

*Exercise 2;
title  'NIH Training Awards';
title2 'Amounts Granted';
proc report data=rep.awards nowd headskip headline;
 column stname year,traamt pctinc;
 define year / 'Year/ ' across;
 define stname / 'State/ ' group;
 define traamt / ' ' format=dollar14. center;
 define pctinc / 'Percent/Increase/ ' computed f=percent8.2;
 compute pctinc;
   pctinc=(_c3_-_c2_)/_c2_;
 endcomp;
run;
```

```
*Exercise 3;
*solution 1: use FELAMT, RESAMT, TRAAMT as analysis vars (default);
title  'NIH Fellowship, Research and Training Awards';
proc report data=rep.awards nowd headskip headline;
 column year stname univname felamt resamt traamt total;
 define year / 'Year' order;
 define stname / 'State' order;
 define univname / 'University' order;
 define felamt / 'Fellowship' format=dollar14.;
 define resamt / 'Research' format=dollar14.;
 define traamt / 'Training' format=dollar14.;
 define total / 'Total' computed format=dollar14.;
 compute total;
   total=felamt.sum+resamt.sum+traamt.sum;
 endcomp;
run;

*solution 2: use FELAMT, RESAMT, TRAAMT as display vars;
title  'NIH Fellowship, Research and Training Awards';
proc report data=rep.awards nowd headskip headline;
 column year stname univname felamt resamt traamt total;
 define year / 'Year' order;
 define stname / 'State' order;
 define univname / 'University' order;
 define felamt / 'Fellowship' format=dollar14. display;
 define resamt / 'Research' format=dollar14. display;
 define traamt / 'Training' format=dollar14. display;
 define total / 'Total' computed format=dollar14.;
 compute total;
   total=felamt+resamt+traamt;
 endcomp;
run;
```

```
/*-------------------------------------------------
| WORKSHOP 3                                      |
 -------------------------------------------------*/
*Exercise 1;
data types;
 set rep.awards;
 array amtaward(5) resamt traamt conamt felamt othamt;
 array naward(5) resn tran conn feln othn;
 do type=1 to 5;
   amount=amtaward(type);
   num=naward(type);
   output;
 end;
 keep stname year type amount num;
run;

proc format;
 value atype 1='Research' 2='Training' 3='Contracts'
             4='Fellowships' 5='Other';
run;

proc report data=types nowd headline headskip;
 column year type num amount avgamt;
 define year   / 'Year' group;
 define type   / 'Award Type' group order=internal f=atype.;
 define num    / 'N' analysis sum center f=comma5.;
 define amount / 'Total' f=comma12. center;
 define avgamt / 'Average' computed f=comma8. center;
 break after year  / skip;
 compute avgamt;
   avgamt=amount.sum/num.sum;
 endcomp;
run;
```

```
*Exercise 2;
title  'NIH Awards Granted to Medical Schools';
title2 'District of Columbia, Maryland and Virginia';
proc report data=types nowd headline headskip;
 column year type num amount avgamt pct;
 define year   / 'Year' group;
 define type   / 'Award Type' group order=internal f=atype.;
 define num      / 'N' analysis sum center f=comma5.;
 define amount / 'Total' f=comma12. center;
 define avgamt / 'Average' computed f=comma8. center;
 define pct / 'Percent' computed f=6.2 width=7;
 break after year  / skip;
 compute avgamt;
   avgamt=amount.sum/num.sum;
 endcomp;
 compute before year;
   yrtot=amount.sum;
 endcomp;
 compute pct;
   pct=100*amount.sum/yrtot;
 endcomp;
run;
```

```
*Exercise 3;
title  'NIH Awards Granted to Medical Schools';
title2 'District of Columbia, Maryland and Virginia';
proc report data=types nowd headline headskip;
 column year type avgamt num amount;
 define year   / 'Year' group;
 define type   / 'Award Type' group order=internal f=atype.;
 define num    / 'N' analysis sum center f=comma5.;
 define amount / 'Total' f=comma12. center;
 define avgamt / 'Average' computed f=comma8. center;
 break after year  / skip;
 compute before type;
   avg=amount.sum/num.sum;
 endcomp;
 compute avgamt;
   avgamt=avg;
 endcomp;
run;
```

```
/*-------------------------------------------------
| WORKSHOP 4                                      |
 -------------------------------------------------*/
*Exercise 1;
title  'NIH Fellowship, Research and Training Awards';
title2 'Total and Maximum Amount Granted';
proc report data=rep.awards nowd headskip headline outrept=rep.gr_rept.stats noexec;
 column year stname felamt,(sum max) resamt,(sum max) traamt,(sum max);
 define year / 'Year' group;
 define stname / 'State' group;
 define felamt / 'Fellowship/--';
 define resamt / 'Research/--';
 define traamt / 'Training/--';
 define sum / 'Total' format=dollar14.;
 define max / 'Maximum' format=dollar14.;
 break after year / skip summarize suppress dol;
run;

*Exercise 2;
title  'NIH Fellowship, Research and Training Awards';
title2 'Total and Average Amount Granted';
title4 'Year: 1998';
proc report data=rep.awards98 nowd report=rep.gr_rept.stats;
run;
```